Cal/EPA

California Environmental Protection Agency

Air Resources Board

H A A G E N - S M I T LABORATORY
P.O. Box 8001
9528 Telstar Avenue
El Monte, CA
91734-8001

MAIL-OUT MSO #97-01

March 6, 1997

TO: ALL MANUFACTURERS OF PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES
ALL OTHER INTERESTED PARTIES

SUBJECT: 1998 and Subsequent Model Year (MY) Certification Application Format

This Mail-out transmits the revised Supplemental Data Sheet (SDS) and Certification Review Sheet (CRS) for passenger cars (PC), light-duty trucks (LDT), and medium-duty vehicles (MDV) that are chassis dynamometer-tested. The SDS and CRS are based on the Air Resources Board's (ARB's) certification requirements for the 1998 and subsequent MYs and should be included in the 1998 and subsequent MY applications for certification to expedite the review process. This Mail-out also highlights some format requirements that were occasionally misunderstood by some manufacturers in previous certifications.
Note: This Mail-out does not include the SDS and CRS for zero-emission vehicles (ZEVs); the 1998 MY application format for ZEVs will be disseminated separately in a forthcoming ARB Mail-out. Also, this Mail-out does not include the SDS and CRS for incomplete medium-duty vehicles that are engine dynamometer-tested, heavy-duty vehicles, and heavy-duty engines; the 1998 MY application format for these vehicles/engines will be disseminated in a United States Environmental Protection Agency (U.S. EPA) correspondence. Lastly, this Mail-out does not include the SDS and CRS for on-road motorcycles, utility and lawn and garden equipment, and specialty vehicles and engines; the 1998 MY application format for these vehicles/engines are unchanged.

A. Revisions: The following items have been added to the SDS and/or CRS. (If an item is not applicable, please designate "N/A".)

1. Projected emissions and deterioration factors (DFs) for the Onboard Refueling Vapor Recovery (ORVR) emission standard set forth in Section 1978 of Title 13, California Code of Regulations (13 CCR 1978) have been added to the CRS.

2. Evaporative Emission Test Procedure:
   California____ Federal____

   Section 4.j. of the "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" allows manufacturers to conduct the evaporative emission test using the U.S. EPA's federal 9.0 psi Reid vapor pressure fuel and 95 degree Fahrenheit test temperature in conjunction with the rest of the California requirements. (This policy is expounded upon in Manufacturers Advisory Correspondence #96-05.) If such federal fuel and test temperature is used, then the Federal__x__ designation on the SDS and CRS should be checked. Otherwise, the California__x__ designation should be checked.

3. The section and page number for the following phase-in schedules have been added to item 32 on page 1 of the CRS.

   a. Subsection (a)(3) of 13 CCR 1978 (ORVR) sets forth a phase-in schedule from MY 1998 through 2006 for compliance with the ORVR standards.

   b. Subsection (b)(3.3.2) of 13 CCR 1968.1 (On-Board Diagnostics II or OBD II) sets forth a phase-in schedule from MY 1997 through 1999 to implement expanded or "full range" misfire monitoring.

   c. Subsection (b)(1.2.2) of 13 CCR 1968.1 (OBD II) sets forth a phase-in schedule for low- and ultra-low emission vehicles from MY 1998 through 1999 to implement a catalytic converter malfunction criterion that is based on an emission threshold 1.5 times the applicable hydrocarbon standard.

   d. Subsection (b)(4.2.2) of 13 CCR 1968.1 (OBD II) sets forth a phase-in schedule from MY 2000 through 2001 to implement diagnostic strategies to detect fuel system leaks greater than or equal in magnitude to a leak caused by a 0.020 inch diameter orifice.

   e. Section 3.j., note (10), of the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (CA Exhaust Test Procedures) sets forth a phase-in schedule from MY 1998 through 2003 for MDVs certified to the LEV and ULEV standards.

B. Clarifications: The following is an explanation of the new terms that have been added to the SDS and CRS for the 1998 MY, as well as an explanation of the terms in the SDS and CRS which in the past were commonly misunderstood/misused by manufacturers.

1. All Engine Codes in Engine Family: CA___ 49S___ 50S__ AB965___

   The purpose of this designation is to identify **all** different **types** of engine codes within an engine family.

   If an engine family has just California-only engine codes, then the CA_X_ designation should be checked.

   If an engine family has California-only and 49-State engine codes, then both CA_X_ and 49S_X_ designations should be checked; the 50S___ designation should NOT be checked. (In the past, only 50S_X_ was checked; this resulted in a very high proportion of California vehicles that were incorrectly thought as being available in all 50 states.)

   If an engine family has only 50-State engine codes, that is, all vehicles in this engine family can be sold in all fifty states, then the 50S_X_ designation should be checked.

   If an engine family is only federally certified and is certified for sale in California under AB965 provisions, then both 49-State_X_ and AB965_X_ designations should be checked.

   If an engine family has distinct California-only engine codes and 49-State codes, and some 49-State engine codes are also certified for sale in California under AB965 provisions, then the California-only _X_, 49-State_X_, and AB965_X_ designations should be checked.

2. Fuel Type(s): Dedicated___ Flex-Fuel___ Dual-Fuel___ Bi-Fuel___ Gasoline___ Diesel___ CNG___ LNG___ LPG___ M85__ Other (specify)_____

   A fuel-flexible vehicle (FFV) is any methanol-fueled or ethanol-fueled motor vehicle that is engineered and designed to be operated using any gasoline-methanol or gasoline-ethanol fuel mixture or blend. An FFV typically has one on-board fuel tank containing the blend.

A dual-fuel vehicle is any motor vehicle that is engineered and designed to be capable of operating on gasoline or diesel and on compressed natural gas (CNG) or liquefied petroleum gas (LPG) with separate on-board fuel tanks for each fuel. In operation, only one fuel is used at a time.

A bi-fuel vehicle is any motor vehicle that is engineered and designed to be capable of operating on two fuels wherein the two fuels are stored on board in separate fuel tanks and metered separately, but in operation the two fuels are combusted together.

Example: A dual-fuel vehicle operates on either gasoline or CNG: For this case, the Dual-Fuel X , Gasoline X , and CNG X designations should be checked.

3. Exh Emiss Test Fuel(s): Indo___ CBG___ CNG__ LPG___ M85___
Diesel: 13 CCR 2282__ 40 CFR 86.113-90___
40 CFR 86.113-94___ Other (specify)_____

The fuel(s) used by the emission data vehicle for certification exhaust emission testing should be listed as follows:

Indo X for Indolene Clear specified in Title 40, Code of Federal Regulations, Section 86.113-94 (40 CFR 86.113-94).

CBG X for "cleaner burning gasoline" specified in Section 9.a.1., paragraph a.1.ii. in the CA Exhaust Test Procedures.

CNG X for compressed natural gas specified in 13 CCR 2292.5 and Section 9.a.13. of the CA Exhaust Test Procedures.

LPG X for liquefied petroleum gas specified in 13 CCR 2292.6 and Section 9.a.13. of the CA Exhaust Test Procedures.

M85 X for methanol specified in T13 CCR 2292.2.

4. PC/LDT/MDV Non-Methane Organic Gas (NMOG) Test Procedure

The manufacturer should indicate either the standard procedure described in the ARB's "California Non-Methane Organic Gas Test Procedures", or the manufacturer's ARB-approved equivalent NMOG test procedure.

5. PC/LDT/MDV Service Accumulation

For exhaust emission purposes, the method for demonstrating durability and determining deterioration factors (DFs) needs to be specified as either the standard Automobile Manufacturers Association (AMA) cycle (Std AMA), or minorly modified AMA (Mod AMA), or alternate durability process (ADP) (e.g., component bench aging; any vehicle driving schedule that significantly deviates from the standard AMA driving cycle and that is approved by the ARB as an ADP). If assigned DFs (ADFs) are used thereby precluding a need to determine the DFs through a durability demonstration, "Other (specify) ADF " should be designated.

6. Part Numbers (Certification Application and SDS)

The part number **as found on the parts** should be reported instead of the manufacturer's inventory/stock number. This is to facilitate parts verification by ARB personnel while conducting field activities, such as Title-13, in-use recall, and in-use surveillance testing. (The manufacturer's inventory/stock numbers may still be added next to the part numbers as supplemental information by using parentheses.)

C. Requirements for the Certification Applications

1. Labeling of Statutory Low-Emission Vehicles

California Health and Safety Code section 39037.05 (HSC 39037.05) defines which vehicle can be identified by the ARB as a "low-emission motor vehicle" (Note: this is not synonymous with the low-emission standard categories of "TLEV", "LEV" or "ULEV" defined in the ARB's CA Exhaust Test Procedure). Pursuant to HSC 43802(a), a vehicle identified by the ARB as a statutory low-emission vehicle must be so labeled. Manufacturers can satisfy this labeling requirement by including on the Vehicle Emission Control Information label, or "tune-up label" a statement such as "HSC 39037.05 Low-Emission Motor Vehicle". Other methods for this compliance can be used if approved in advance by the ARB. The label wording and the label's location on the vehicle must be indicated in the engine family's certification application in either Section 7 or Section 17.

For PCs and LDTs, a statutory low-emission vehicle is a vehicle that is certified to a hydrocarbon exhaust emission standard whose numerical value is equal to or less than half of the numerical value of the NMOG fleet average for the applicable MY and vehicle class. The certification emission standards for 1998 and subsequent MY PCs and LDTs which qualify a vehicle as statutory low-emission are summarized below:

MODEL YEAR	CERTIFICATION STANDARD
1998	LEV, ULEV, ZEV
1999	ULEV, ZEV
2000 and subsequent	ZEV

All MDVs certified to the LEV, ULEV, SULEV and ZEV standards meet the definition of statutory low-emission vehicle.

2. Smog Index Label

Section 3.5 of the "California Motor Vehicle Emission Control and Smog Index Label Specifications" sets forth a requirement applicable to 1998 and subsequent MY new PCs and LDTs for a Smog Index label to be affixed in a location specified in section 43200 of the Health and Safety Code. The Smog Index conveys to the customer a relative measure of the vehicle's pollution potential based on the vehicle's class, emission standard, and fuel type. Typically, the Smog Index label is located on a side window to the rear of the driver. The Smog Index label may be incorporated into the new vehicle's window sticker. Prior to certification, each manufacturer should submit to the ARB a copy of their typical Smog Index label design for review and approval.

3. Vehicle Emission Configuration (VEC) Bar Code

Section 3.b. of the "California Motor Vehicle Emission Control and Smog Index Label Specifications" requires adding a ninth character to the current eight-character VEC bar-code label to identify the vehicle's California exhaust emission standard beginning with the 1998 model year. The label regulation further specifies that the ninth character shall not be necessary if the sixth character of the VEC bar-code label correctly identifies the vehicle's California exhaust emission standard. Details of the 1998 MY eight-character VEC bar-code label format can be found in Manufacturers Advisory Correspondence #96-10, and the "Recommended Practice for Bar-Coded Vehicle Emission Configuration Label" as contained in the Society of

Automotive Engineers (SAE) Standards J1892 for the VEC bar-coded label format. The VEC bar-code label is used by California Inspection and Maintenance personnel and other technicians in the field to correctly identify a vehicle's exhaust emission standard. As such, the ARB needs to review the VEC bar codes for accuracy and uniqueness. Prior to certification, each manufacturer should submit to the ARB a list of all VEC bar codes for the model year. Only the human readable portion of the VEC bar codes need be submitted. The VEC bar code list can be included with the comprehensive lists of engine families that are usually submitted at the beginning of a manufacturer's certification process.

4. Required Supplemental Information and Data for Compliance with the Enhanced Evaporative Requirements

   The enhanced evaporative emission control emission standards and test procedures require data and information that are specific to these requirements, for example, fuel tank temperature and pressure profiles, the correction method for correcting measured profiles at the prevailing temperature to the reference temperature, the use of a worst-case profile to represent a group of vehicles, etc. Other information that was previously required under the non-enhanced evaporative test procedures remains the same unless specifically superseded by the supplemental information. The attached document entitled "Required Supplemental Information and Data for Compliance with the Enhanced Evaporative Requirements" describes such required supplemental information, and where the information should be presented in the certitfication application.

Should you have any comments or questions, please contact Mr. Duc Nguyen, Manager, Certification Section, or Mr. Steven Hada, Certification Staff, at (818) 575-6641.

Sincerely,

R. B. Summerfield, Chief
Mobile Sources Operations Division

Attachments

E.O.#_____

_____ MODEL-YEAR AIR RESOURCES BOARD SUPPLEMENTAL DATA SHEET Page 1
PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

Manufacturer:_____ Exh Eng Fam:_____ Evap Fam:_____

All Engine Codes in Engine Familiy: CA___ 49S___ 50S___ AB965__, ORVR: YES___ NO___

Exh Std: CA Tier-1____ TLEV____ LEV____ ULEV____ SULEV____, US EPA Tier-1____

Veh Class(es): PC____ LDT1____ LDT2____ MDV1___ MDV2____ MDV3____ MDV4____ MDV5___

Single Cert Std for Multi-Class Eng Fam:_____(specify: N/A, LDT1, MDV1, MDV2, MDV3, MDV4)

Fuel Type(s): Dedicated___ Flex-Fuel___ Dual-Fuel___ Bi-Fuel___ Gasoline___ Diesel__
CNG___ LNG___ LPG___ M85___ Other (specify)_____

Exh Emiss Test Fuel(s): Indo___ CBG___ CNG___ LPG___ M85____ Other (specify)_____
Diesel: 13 CCR 2282___ 40 CFR 86.113-90___ 40 CFR 86.113-94___

Evaporative Emission Test Procedure: California_____ Federal_____

Service Accum: Std AMA___ Mod AMA____ Mfr ADP___ Other (specify)_____

NMOG Test Procedure: N/A____ Std___ Equiv___ R/L Test Proc: SHED___ Pt Source___

Engine Configuration:_____ Displacement:_____/_____Liters _____/_____Cubic Inches

Valves per Cylinder:_____ Rated HP:_____@_____RPM

Engine: Front____ Mid____ Rear____ Drive: FWD____ RWD____ 4WD-FT____ 4WD-PT____

Exhaust ECS (e.g., MFI, EGR, TC, CAC):_____
(use abbreviations per **SAE J1930 JUN93**)

Engine Code (also list CA/49ST/50ST)	Vehicle Models (if coded see attachment)	Trans. (M5, A4 etc.)	ETW or Test Wt.	DPA or RLHP	Ignition (ECM/PCM) Part No.	EGR System Part No.	Catalytic Converter Part No.

Date Issued: Revisions:

E.O.#_____

_____ MODEL-YEAR AIR RESOURCES BOARD SUPPLEMENTAL DATA SHEET Page____
PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

(Continued)

Manufacturer:_____ Exh Eng Fam:_____ Evap Fam:_____

Engine Code (also list CA/49ST/50ST)	Vehicle Models (if coded see attachment)	Trans. (M5, A4 etc.)	ETW or Test Wt.	DPA or RLHP	Ignition (ECM/PCM) Part No.	EGR System Part No.	Catalytic Converter Part No.

Date Issued: Revisions:

E.O.#_____

_____MODEL-YEAR AIR RESOURCES BOARD CERTIFICATION REVIEW SHEET
PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES Page_____

Manufacturer:_____ Exh Eng Fam:_____ Evap Fam:_____

All Engine Codes in Engine Familiy: CA___ 49S___ 50S___ AB965__, ORVR: YES___ NO___

Exh Std: CA Tier-1____ TLEV____ LEV____ ULEV____ SULEV____, US EPA Tier-1____

Veh Class(es): PC____ LDT1____ LDT2____ MDV1___ MDV2____ MDV3____ MDV4____ MDV5___

Single Cert Std for Multi-Class Eng Fam:_____(specify: N/A, LDT1, MDV1, MDV2, MDV3, MDV4)

Fuel Type(s): Dedicated___ Flex-Fuel___ Dual-Fuel___ Bi-Fuel___ Gasoline___ Diesel__
CNG___ LNG___ LPG___ M85___ Other (specify)_____

Exh Emiss Test Fuel(s): Indo___ CBG___ CNG___ LPG___ M85____ Other (specify)_____
Diesel: 13 CCR 2282___ 40 CFR 86.113-90___ 40 CFR 86.113-94___

Evaporative Emission Test Procedure: California_____ Federal_____

Service Accum: Std AMA___ Mod AMA____ Mfr ADP___ Other (specify)_____

NMOG Test Procedure: N/A____ Std___ Equiv___ R/L Test Proc: SHED___ Pt Source___

Engine Configuration:_____ Displacement:_____/_____Liters _____/_____Cubic Inches

Valves per Cylinder:_____ Rated HP:_____@_____RPM

Engine: Front____ Mid____ Rear____ Drive: FWD____ RWD____ 4WD-FT____ 4WD-PT____

Exhaust ECS (e.g., MFI, EGR, TC, CAC):_____
(use abbreviations per **SAE J1930 JUN93**)

	Sect/Page #		Sect/Page #
1 Authorized Representative			
2 Fuel Specifications		22 Gen Std, Increase in Emiss, Safety, Meets all Reqmts	
3 Test Equipment		23 Driveability Statement	
4 Test Procedure		24 Adjustable Parameters	
5 Mileage Accumulation Route		25 Tamper Resistance Method(s)	
6 Emission Warranty Statemnt		26 Fill Pipe Specifications	
7 Maint: Cert/Req'd/Recm'		27 High Altitude Compliance	
8 Emiss Label/Vac Hose Dia		28 OBD Sys incl Marked Revisions	
9 Evap Control System (incl. ORVR if applic.)		29 I&M Test Procedure & Data	
10 Engine Parameters		30 50 Degree F Compliance	
11 Fuel System		31 Manufacturer's RAF	
12 Ignition System		32 Phase-In Sched: ORVR Cert Std	
13 Exhaust Control System		Full Range Misfire Monitoring	
14 Proj Sales (LDT/MDV Split)		LEV CAT Monitoring--1.5 x Std	
15 Vehicle Description		0.020" Orifice-Based Leak Chk	
16 Evap Bench Test Procedure		MDV VEC Calculation	
17 R/L Temp & Press Profiles		33 NMOG Fleet Average Calculation	
18 EDV Selection		34 AB965 Credits/Withdrawals	
19 Prod Veh same as Test Veh		35 EPA Certificate	
20 Emission Label Durability		36 Equiv NMOG Proc--ARB Approval	

21 Test Vehicle Information	Durability Data Vehicle	Emission Data Vehicle	Emission Data Vehicle	Emission Data Vehicle
C/O or C/A MY & ID	_____ _____	_____ _____	_____ _____	_____ _____
Vehicle Log Page(s)				
Zero Mile Book Page(s)				
Maint Logs & Engr Eval				

Continued on next page

_____ MODEL-YEAR CERTIFICATION REVIEW SHEET E.O.#_____

PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

Manufacturer: _____ Exhaust Engine Family: _____ Evaporative Family: _____

P R O J E C T E D E M I S S I O N S

(grams/mile, except, grams/test for D+HS, and grams/gallon for ORVR) (1) (2)

Emission Data Vehicle ID (3)	Engine Code & Displ	Test Loc	Trans	(Check One) TW ETW	(Check One) DPA RLHP	MPG City/Hwy	(Check One) NMHC NMOG	CO	NOx	HCHO	20°F CO	PM	EVAPORATIVE Hwy NOx	City CO2	3-day D+HS	R/L	2-day D+HS	ORVR
(1) The Emission Data Vehicle(s) above comply with standards of (@ 50K):														n.a.	n.a.	n.a.	n.a.	n.a.
(@ 100K for PC & LDT, 120K for MDV):											n.a.			n.a.		0.05		
The NMOG values include Reactivity Adjustment Factor(s) (RAF) of: Not Applicable ____ NMOG _____ Methane (CNG or LNG only) _____																		
Emission values include deterioration factors (DFs) (with RAF deterioration, if applicable) of (50K):														n.a.	n.a.	n.a.	n.a.	n.a.
(100K for PC and LDT, 120K for MDV):											n.a.			n.a.				
TLEV/LEV/ULEV/SULEV 50°F emissions (with RAF but without DFs):																		
TLEV/LEV/ULEV/SULEV 50°F standards:																		

(2) Evaporative DFs are the average of: **3-day D+HS** Vehicle DF _____ and **3-day D+HS** Bench DF _____, **R/L** Vehicle DF _____ and **R/L** Bench DF _____,

2-day D+HS Vehicle DF _____ and **2-day D+HS** Bench DF _____. **ORVR** Bench DF _____.

(3) List the configuration with the highest projected sales first.

Remarks _____

_____

Application
Processed by _____ Date _____ Reviewed by _____ Date _____

Date Issued: Revised:

REQUIRED SUPPLEMENTAL INFORMATION AND DATA
FOR COMPLIANCE WITH THE ENHANCED EVAPORATIVE REQUIREMENTS

The following are supplemental information that is required for compliance with the enhanced evaporative emission control test procedures. Other information that were previously required under the unenhanced evaporative emission control test procedures remain the same unless specifically superseded by the above supplemental information. The supplemental information should be described in the sections of the application for certification as listed below:

	Application Section #
1. Canister Bed Volume	Section 19
2. Canister Nominal Working Capacity (based on determination in test procedures)	Section 19
3. Canister Loading Procedure. If different from prescribed test procedures, describe & indicate ARB approval.	Section 19
4. Fuel Tank Temperature Profile (FTTP) and Pressure Profile	
A. The following FTTP and pressure profile are to be presented in graphical form [time versus temperature (degrees F); time versus pressure (inches of H_2O)]. The scale/resolution of the profiles should be sufficient to allow subsequent performance of running loss testing.	
a. Measured Average Fuel Temperature Profile	Section 12
b. Measured Vapor Space Temperature Profile	Section 12
c. Measured Vapor Space Pressure Profile	Section 12
d. Corrected Average Fuel Temperature Profile	Section 19
e. Corrected Vapor Space Temperature Profile	Section 19
B. Ambient Conditions	Section 12
List ambient conditions which existed during the measurement of each of the profiles A.a, A.b and A.c above.	
C. Test Vehicles for FTTP and Pressure Profiles	Section 12
Test vehicles for the generation of each of the profiles A.a, A.b and A.c above are to be described.	

REQUIRED SUPPLEMENTAL INFORMATION AND DATA
FOR COMPLIANCE WITH THE EVAPORATIVE REQUIREMENTS
(continued)

D. FTTP Correction Method — Section 19

Describe the method for correcting the FTTPs measured at the prevailing ambient temperature to the reference temperature. If an alternative method is used, indicate the ARB approval of the alternative FTTP correction method.

E. Single FTTP to Represent a Group of Vehicle Models — Section 19

For each corrected FTTP representing a group of vehicle models, describe the worst-case vehicle model that was tested for generating the FTTP, include a listing of all vehicle models whose FTTPs are represented by the worst-case test vehicle and, include an engineering evaluation to support the manufacturer's selection of each such worst-case test vehicle.

5. Bench Test Procedure — Section 13

Describe the evaporative bench test procedure, including specific bench test parameters and the ARB approval of the bench test procedure.

6. Unique Procedure or Equipment — Section 19

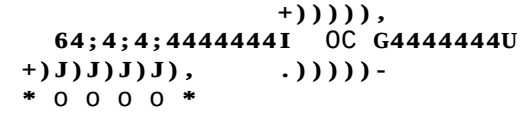
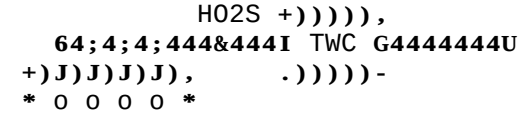
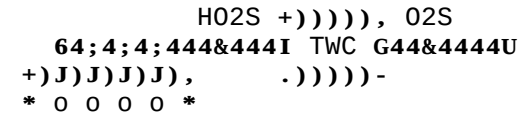
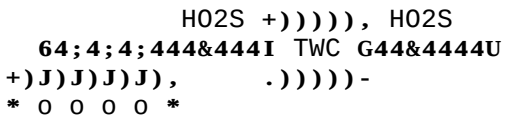
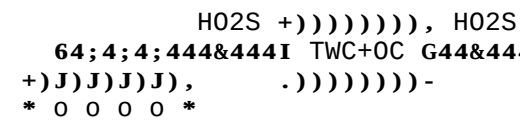
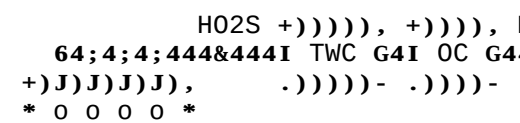
Describe any unique procedure or equipment necessary to perform evaporative emission testing, and the ARB approval of such unique procedure or equipment.

7. For heavy-duty gasoline- or methanol-fueled vehicles, Section 19 describe the vehicle manufacturer's maximum nominal fuel tank capacity for each evaporative family to be certified.

8. Evaporative Emission Test Log — Section 12

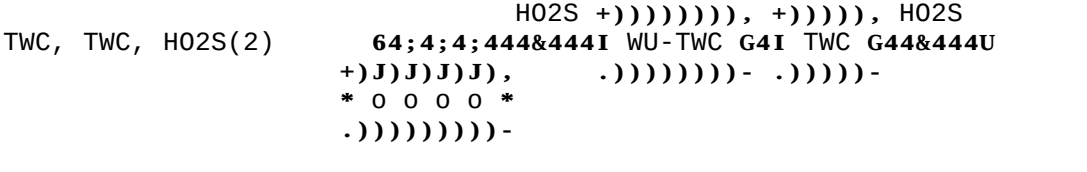
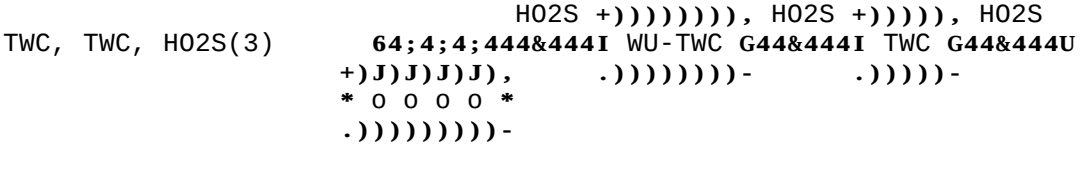
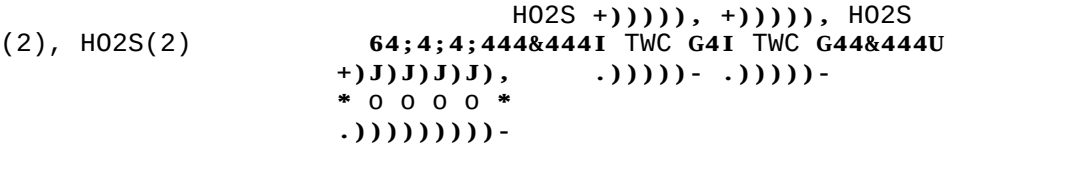
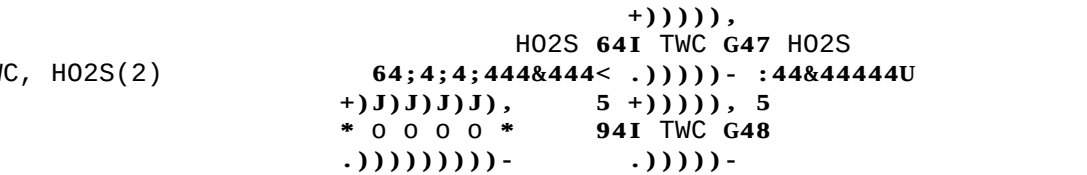
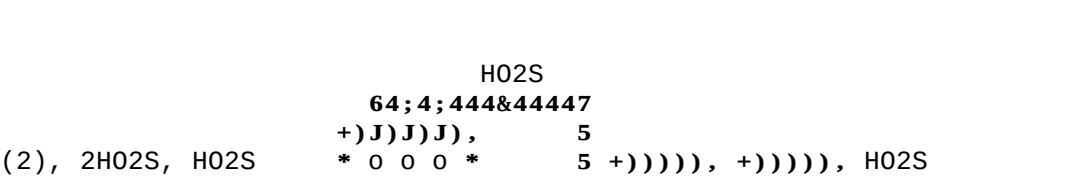
a. Vehicle Description
b. Individual 24-Hour Diurnal Test Values
   (3 for 3-day sequence; 2 for 2-day sequence)
c. Running Loss Test Result
d. Corresponding Exhaust Emission Test Results

EXAMPLES OF CATALYTIC CONVERTER AND OXYGEN SENSOR ABBREVIATIONS & CONFIGURATIONS

	NOMENCLATURE	SDS & CRS ABBREVIATIONS	CONFIGURATION
a.	Oxidation Catalytic Converter	OC	
b.	Three-Way Catalytic Converter, Heated Oxygen Sensor	TWC, HO2S	
c.	Three-Way Catalytic Converter, Heated Oxygen Sensor, Oxygen Sensor	TWC, HO2S, O2S	
d.	Three-Way Catalytic Converter, Heated Oxygen Sensors (two)	TWC, HO2S(2)	
e.	Three-Way plus Oxidation Catalytic Converter, Heated Oxygen Sensors (two)	TWC+OC, HO2S(2)	
f.	Three-Way Catalytic Converter, Oxidation Catalytic Converter, Heated Oxygen Sensors (two)	TWC, OC, HO2S(2)	

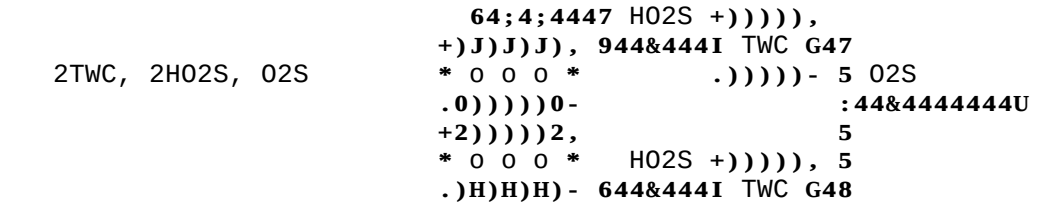
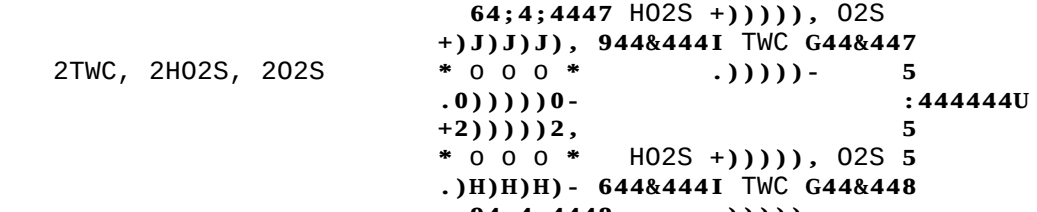
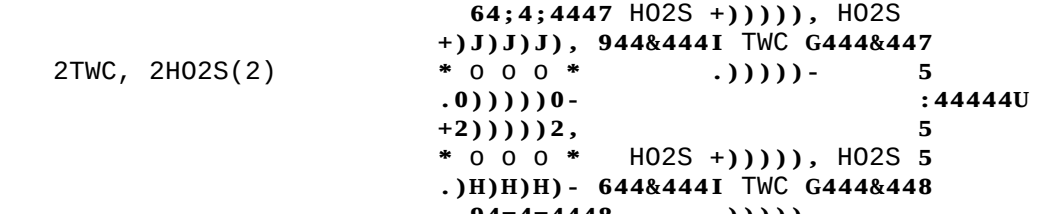
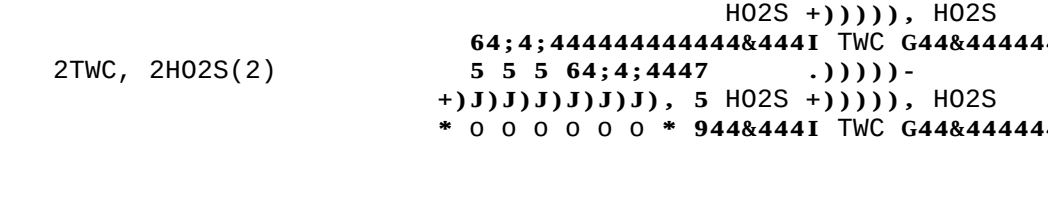
.)))))))))-

EXAMPLES OF CATALYTIC CONVERTER AND OXYGEN SENSOR ABBREVIATIONS & CONFIGURATIONS
(Continued)

	NOMENCLATURE	SDS & CRS ABBREVIATIONS	CONFIGURATION
g.	Warm Up Three-Way Catalytic Converter, Three-Way Catalytic Converter, Heated Oxygen Sensors (two)	WU-TWC, TWC, HO2S(2)	
h.	Warm Up Three-Way Catalytic Converter, Three-Way Catalytic Converter, Heated Oxygen Sensors (three)	WU-TWC, TWC, HO2S(3)	
i.	Three-Way Catalytic Converters (two), Heated Oxygen Sensors (two)	TWC(2), HO2S(2)	
j.	Dual Three-Way Catalytic Converters, Heated Oxygen Sensors (two)	2TWC, HO2S(2)	
k.	Three-Way Catalytic Converters (two), Dual Heated Oxygen Sensors, Heated Oxygen Sensor	TWC(2), 2HO2S, HO2S	

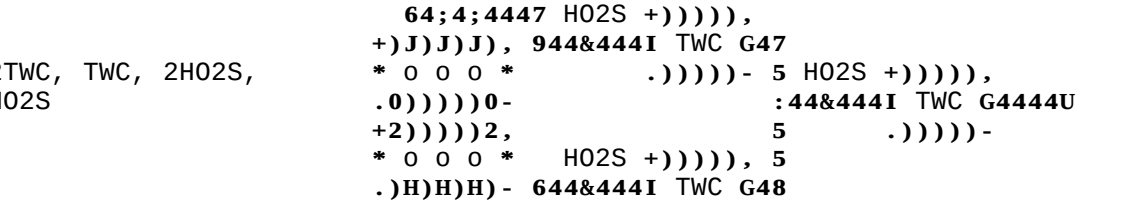
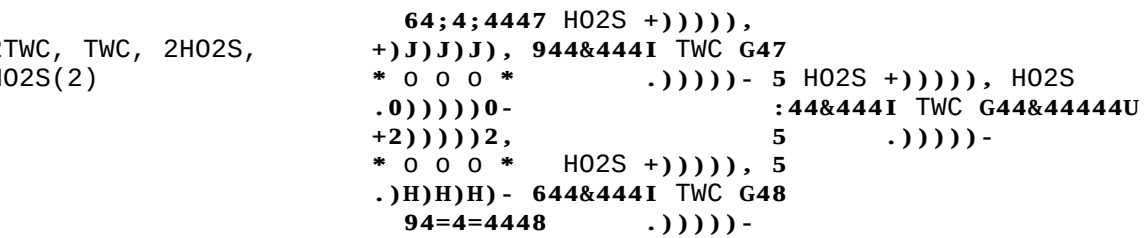
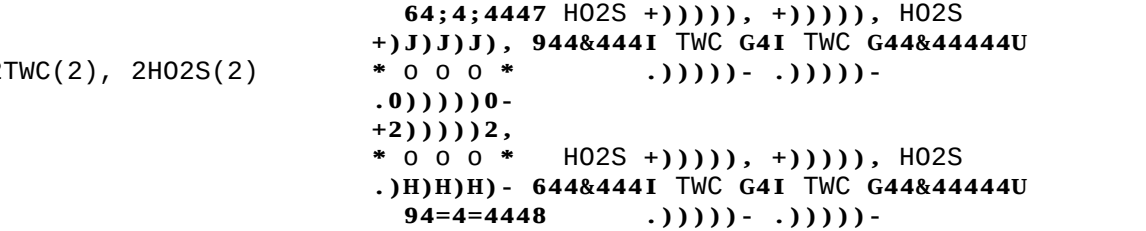
94=4=4444&4448

EXAMPLES OF CATALYTIC CONVERTER AND OXYGEN SENSOR ABBREVIATIONS & CONFIGURATIONS
(Continued)

	NOMENCLATURE	SDS & CRS ABBREVIATIONS	CONFIGURATION
l.	Dual Three-Way Catalytic Converters, Dual Heated Oxygen Sensors (two), Oxygen Sensor	2TWC, 2HO2S, O2S	
m.	Dual Three-Way Catalytic Converters, Dual Heated Oxygen Sensors, Dual Oxygen Sensors	2TWC, 2HO2S, 2O2S	
n.	Dual Three-Way Catalytic Converters, Dual Heated Oxygen Sensors (two)	2TWC, 2HO2S(2)	
o.	Dual Three-Way Catalytic Converters, Dual Heated Oxygen Sensors (two)	2TWC, 2HO2S(2)	

.)))))))))))))- .)))))-

EXAMPLES OF CATALYTIC CONVERTER AND OXYGEN SENSOR ABBREVIATIONS & CONFIGURATIONS
(Continued)

	NOMENCLATURE	SDS & CRS ABBREVIATIONS	CONFIGURATION
p.	Dual Three-Way Catalytic Converters, Three-Way Catalytic Converter, Dual Heated Oxygen Sensors, Heated Oxygen Sensor	2TWC, TWC, 2HO2S, HO2S	
q.	Dual Three-Way Catalytic Converters, Three-Way Catalytic Converter, Dual Heated Oxygen Sensors, Heated Oxygen Sensors)two)	2TWC, TWC, 2HO2S, HO2S(2)	
r.	Dual Three-Way Catalytic Converters (two), Dual Heated Oxygen Sensors (two)	2TWC(2), 2HO2S(2)	

NOTES:

1. "Dual" or "2" in a prefix position means parallel arrangement. "(Two)" or "(2)" in a parenthetic suffix position means series arrangement.
2. Multiple "bricks" within a single "can" is considered a single catalytic converter.
3 An Electrically Heated Catalytic Converter (EHC) should be identified separately.
4. An Air/Fuel Sensor, also known as Universal Exhaust Gas Oxygen Sensor, should be identified separately. Currently, SAE J1930 does not include a standard nomenclature for an Air/Fuel Sensor. Until a standard is established, manufacturers using such a sensor should propose a monenclature in their certification application.